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EXAMINER	
GUILL, RUSSELL L	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/782,745	COLLODI, DAVID J.	
	Examiner	Art Unit	
	Russ Guill	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 July 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-52* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-52* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This Office action is in response to an Amendment filed July 7, 2010. No claims were added or canceled. Claims 1 - 52 are pending. Claims 1 – 52 have been examined. Claims 1 – 52 have been rejected.

Response to Arguments

2. Regarding claims rejected under 35 U.S.C. § 101:

   a. The Applicant argues that the claims have been amended to overcome the rejections. The Examiner respectfully disagrees, as discussed below in the sections for rejections under 35 U.S.C. § 101 and 35 U.S.C. § 112, second paragraph.

3. Regarding claims rejected under 35 U.S.C. § 112, second paragraph:

   a. The Applicant argues that the claims have been amended to overcome the rejections as suggested by the Examiner. Applicant's claim amendments overcome most of the rejections; however not all the suggestions were implemented, and thus some rejections are maintained. Further, the Applicant's claim amendments caused additional rejections, as discussed below in the section for rejections under 35 U.S.C. § 112, second paragraph.

4. Regarding independent claim 1 and claims depending therefrom rejected under 35 U.S.C. § 103:

   a. Regarding Applicant's arguments in section II) 1), the Applicant essentially argues that Fisette does not disclose a binary object, i.e., the combination of two objects into a single object to be calculated.

i. The Examiner respectfully replies: Applicant's arguments have been fully considered, but are not persuasive, as follows. Fisette appears to reasonably suggest a binary object as shown on page 193, figure 4 (b), which shows a multibody object represented as a binary tree. In claim 1, step c, a binary object is formed from three objects, which implies that a binary object may have at least three objects. Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references. Accordingly, the rejections are maintained.

5. Regarding independent claim 10 and claims depending therefrom rejected under 35 U.S.C. § 103:

a. Regarding Applicant's arguments in section II) 2), the Applicant essentially argues that Son does not teach changing the reaction values in response to force for at least one object to provide a set of adjusted reaction values. Son does not teach objects that change in response to force.

i. The Examiner respectfully replies: Applicant's arguments have been fully considered, but are not persuasive, as follows. Son is directed to the simulation of rigid body dynamics, which the ordinary artisan would have known to be calculating reactions to forces, as discussed in section 3.3 on page 1378. Section 3.3 teaches calculating updated positions and velocities from applied forces. Thus Son appears to teach the limitation. Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language

of the claims patentably distinguishes them from the references. Accordingly, the rejections are maintained.

6. Regarding independent claim 16 and claims depending therefrom rejected under 35 U.S.C. § 103:

a. Regarding Applicant's arguments in section II) 3), the Applicant essentially argues that Fisette does not disclose a binary object, i.e., the combination of two objects into a single object to be calculated.

i. The Examiner respectfully replies: Applicant's arguments have been fully considered, but are not persuasive, as follows. Fisette appears to reasonably suggest a binary object as shown on page 193, figure 4 (b), which shows a multibody object represented as a binary tree. Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references. Accordingly, the rejections are maintained.

7. Regarding independent claim 25 and claims depending therefrom rejected under 35 U.S.C. § 103:

a. Regarding Applicant's arguments in section II) 4), the Applicant essentially argues that Fisette does not disclose a binary object, i.e., the combination of two objects into a single object to be calculated.

i. The Examiner respectfully replies: Applicant's arguments have been fully considered, but are not persuasive, as follows. Fisette appears to reasonably suggest a binary object as shown on page 193, figure 4 (b), which shows a multibody object represented as a binary tree. Applicant's

arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references. Accordingly, the rejections are maintained.

8. Regarding independent claim 34 and claims depending therefrom rejected under 35 U.S.C. § 103:

a. Regarding Applicant's arguments in section II) 5), the Applicant essentially argues that Baraff does not teach a link weight.

i. The Examiner respectfully replies: Applicant's arguments have been fully considered, but are not persuasive, as follows. The reference of Baraff1994A is directed to simulation of rigid body dynamics, including multibody collisions. The penalty method models contacts between bodies as a spring between each contact point between bodies (a spring is a link between the bodies), and the strength of the spring is a link weight. Thus Baraff1994A appears to teach a link weight. Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references. Accordingly, the rejections are maintained.

9. Regarding independent claim 39 and claims depending therefrom rejected under 35 U.S.C. § 103:

a. Regarding Applicant's arguments in section II) 6), the Applicant essentially argues that Baraff does not teach a link weight.

i. The Examiner respectfully replies: Applicant's arguments have been fully considered, but are not persuasive, as follows. The reference of Baraff1994A is directed to simulation of rigid body dynamics, including multibody collisions. The penalty method models contacts between bodies as a spring between each contact point between bodies (a spring is a link between the bodies), and the strength of the spring is a link weight. Thus Baraff1994A appears to teach a link weight. Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references. Accordingly, the rejections are maintained.

10. Regarding independent claim 45 and claims depending therefrom rejected under 35 U.S.C. § 103:

a. Regarding Applicant's arguments in section II) 7), the Applicant essentially argues that Fisette does not disclose a binary object, i.e., the combination of two objects into a single object to be calculated.

i. The Examiner respectfully replies: Applicant's arguments have been fully considered, but are not persuasive, as follows. Fisette appears to reasonably suggest a binary object as shown on page 193, figure 4 (b), which shows a multibody object represented as a binary tree. Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references. Accordingly, the rejections are maintained.

Claim Rejections - 35 USC § 112

11. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

a. Claims 1 – 44 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

i. An essential purpose of patent examination is to fashion claims that are precise, clear, correct, and unambiguous. Only in this way can uncertainties of claim scope be removed, as much as possible, during the administrative process.

ii. Regarding claim 1, it is unclear where the preamble of the claim ends. For the purpose of claim examination, the preamble is interpreted to end at line 7 with the phrase, "the method further comprising:"

iii. Regarding claim 1, the claim recites in line 15, "solving a solution for the physical dynamics". The meaning of "solving a solution" is unclear, since a solution is already solved. For the purpose of claim examination, the phrase "solving a solution for the physical dynamics" is interpreted as, "solving for the physical dynamics".

iv. Regarding claim 10, it is unclear where the preamble of the claim ends. For the purpose of claim examination, the preamble is interpreted to end at lines 6 - 7 with the phrase, "the method further comprising:"

v. Regarding claim 10, the claim recites in the next to last line, "the solution." The term appears to have insufficient antecedent basis.

vi. Regarding claim 16, it is unclear where the preamble of the claim ends. For the purpose of claim examination, the preamble is interpreted to end at line 7 with the phrase, "the method further comprising:"

vii. Regarding claim 25, it is unclear where the preamble of the claim ends. For the purpose of claim examination, the preamble is interpreted to end at lines 6 - 7 with the phrase, "the method further comprising:"

viii. Regarding claim 25, the claim recites in the last line, "said one or more links." The term appears to have insufficient antecedent basis.

ix. Regarding claim 34, it is unclear where the preamble of the claim ends. For the purpose of claim examination, the preamble is interpreted to end at line 6 with the phrase, "the method further comprising:"

x. Regarding claim 34, the claim recites in lines 18 - 19, "solving an iterative solution for the physical dynamics of the objects using the adjusted weights". The meaning of "solving an iterative solution" is unclear since a solution is already solved. The metes and bounds of the claim cannot be determined.

xi. Regarding claim 39, it is unclear where the preamble of the claim ends. For the purpose of claim examination, the preamble is interpreted to end at line 6 with the phrase, "the method further comprising:"

xii. Regarding claim 39, the claim recites in lines 20 - 21, "solving an iterative solution for the physical dynamics of the objects using the adjusted weights". The meaning of "solving an iterative solution" is

unclear since a solution is already solved. The metes and bounds of the claim cannot be determined.

xiii. Dependent claims inherit the defects of their parent and intermediate claims.

Claim Rejections - 35 USC § 101

12. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

13. Claims 1 – 44 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

a. Regarding claim 1 and dependent claims, the claim appears to be directed entirely to an abstract idea, which is non-statutory. The input data does not appear to be specific, but rather appears to be generic, and not particular in type and nature. The steps of the claim appear to be computation or manipulation of abstract data. The claim does not appear to have a result that is a practical application. It is not until a result is applied in a meaningful way that it has real world value and becomes a practical application. The claim does not appear to have a result that is a practical application because the result of the claim appears to be a grouping of abstract objects and a process of solving for physical dynamics, which appears to be an abstract operation. A claim that covers both statutory and non-statutory embodiments (under the broadest reasonable interpretation of the claim when read in light of the specification and in view of one skilled in the art) embraces subject matter that is not eligible for patent

protection and therefore is directed to non-statutory subject matter. An abstract idea implemented on a computing device is still an abstract idea. Further, a recitation of a computer in the preamble does not appear to be sufficient to tie the process to a particular apparatus.

b. Regarding claim 10 and dependent claims, the claim appears to be directed entirely to an abstract idea, which is non-statutory. The steps of the claim appear to be computation or manipulation of abstract data. The claim does not appear to have a result that is a practical application. It is not until a result is applied in a meaningful way that it has real world value and becomes a practical application. The claim does not appear to have a result that is a practical application because the result of the claim appears to be simply a process of solving for physical dynamics, which appears to be an abstract operation. A claim that covers both statutory and non-statutory embodiments (under the broadest reasonable interpretation of the claim when read in light of the specification and in view of one skilled in the art) embraces subject matter that is not eligible for patent protection and therefore is directed to non-statutory subject matter. An abstract idea implemented on a computing device is still an abstract idea. Further, a recitation of a computer in the preamble does not appear to be sufficient to tie the process to a particular apparatus.

c. Regarding claim 16 and dependent claims, the claim appears to be directed entirely to an abstract idea, which is non-statutory. The input data does not appear to be specific, but rather appears to be generic, and not particular in type and nature. The steps of the claim appear to be computation or manipulation of abstract data. The claim does not appear to have a result that is a practical application. It is not until a result is applied in a meaningful way that it has real world value and becomes a practical application. The claim does not appear to have a result that is a practical application because the result of the claim appears

to be a grouping of abstract objects and a process of solving for physical dynamics, which appears to be an abstract operation. A claim that covers both statutory and non-statutory embodiments (under the broadest reasonable interpretation of the claim when read in light of the specification and in view of one skilled in the art) embraces subject matter that is not eligible for patent protection and therefore is directed to non-statutory subject matter. An abstract idea implemented on a computing device is still an abstract idea. Further, a recitation of a computer in the preamble does not appear to be sufficient to tie the process to a particular apparatus.

d. Regarding claim 25 and dependent claims, the claim appears to be directed entirely to an abstract idea, which is non-statutory. The input data does not appear to be specific, but rather appears to be generic, and not particular in type and nature. The steps of the claim appear to be computation or manipulation of abstract data. The claim does not appear to have a result that is a practical application. It is not until a result is applied in a meaningful way that it has real world value and becomes a practical application. The claim does not appear to have a result that is a practical application because the result of the claim appears to be a process of solving for physical dynamics, which appears to be an abstract operation. A claim that covers both statutory and non-statutory embodiments (under the broadest reasonable interpretation of the claim when read in light of the specification and in view of one skilled in the art) embraces subject matter that is not eligible for patent protection and therefore is directed to non-statutory subject matter. An abstract idea implemented on a computing device is still an abstract idea. Further, a recitation of a computer in the preamble does not appear to be sufficient to tie the process to a particular apparatus.

e. Regarding claim 34 and dependent claims, the claim appears to be directed entirely to an abstract idea, which is non-statutory. The input data does not

appear to be specific, but rather appears to be generic, and not particular in type and nature. The steps of the claim appear to be computation or manipulation of abstract data. The claim does not appear to have a result that is a practical application. It is not until a result is applied in a meaningful way that it has real world value and becomes a practical application. The claim does not appear to have a result that is a practical application because the result of the claim appears to be a process of solving for physical dynamics, which appears to be an abstract operation. A claim that covers both statutory and non-statutory embodiments (under the broadest reasonable interpretation of the claim when read in light of the specification and in view of one skilled in the art) embraces subject matter that is not eligible for patent protection and therefore is directed to non-statutory subject matter. An abstract idea implemented on a computing device is still an abstract idea. Further, a recitation of a computer in the preamble does not appear to be sufficient to tie the process to a particular apparatus.

f. Regarding claim 39 and dependent claims, the claim appears to be directed entirely to an abstract idea, which is non-statutory. The input data does not appear to be specific, but rather appears to be generic, and not particular in type and nature. The steps of the claim appear to be computation or manipulation of abstract data. The claim does not appear to have a result that is a practical application. It is not until a result is applied in a meaningful way that it has real world value and becomes a practical application. The claim does not appear to have a result that is a practical application because the result of the claim appears to be a process of solving for physical dynamics, which appears to be an abstract operation. A claim that covers both statutory and non-statutory embodiments (under the broadest reasonable interpretation of the claim when read in light of the specification and in view of one skilled in the art) embraces subject matter that is not eligible for patent protection and therefore is directed to non-statutory

subject matter. An abstract idea implemented on a computing device is still an abstract idea. Further, a recitation of a computer in the preamble does not appear to be sufficient to tie the process to a particular apparatus.

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

15. **Claims 1, 16, 25 and 45** are rejected under 35 U.S.C. 103(a) as being unpatentable over Fisette (P. Fisette and J.C. Samin; "Symbolic generation of large multibody system dynamic equations using a new semi-explicit Newton/Euler recursive scheme", 1996, Archive of Applied Mechanics, Volume 66, Number 3, pages 187 – 199) in view of Jalon (Javier Garcia De Jalon and Eduardo Bayo; "Kinematic and Dynamic Simulation of Multibody Systems: The Real-Time Challenge", 1993, Springer-Verlag, pages 271 - 325).

a. The art of Fisette is directed to dynamic equations of multibody systems (Title).

b. The art of Jalon is directed to simulation of multibody systems (Title).

c. The art of Fisette and the art of Jalon are analogous art because they are both concerned with simulation of multibody systems.

d. Regarding **claim 1**:

e. Fisette appears to teach:

f. a. grouping a first and a second object in the predetermined set of objects to define a first binary object (**page 193, figure 4, part b**);

g. c. grouping a third object to the first binary object to define a second binary object, the third object having at least one link to the first binary object, thereby defining a second set of links (**page 193, figure 4, part b**);

h. e. recursively grouping additional objects to create additional binary objects and solving for the physical dynamics of the additional binary objects (**page 193, figure 4, part b**).

i. Fisette does not explicitly teach:

j. b. solving for the physical dynamics of the objects in the first binary object at a first set of links;

k. d. solving a solution for the physical dynamics of the objects in the second binary object at the second set of links;

l. Jalon appears to teach:

m. b. solving for the physical dynamics of the objects in the first binary object at a first set of links (**pages 289 - 290, section 8.2.4**);

n. d. solving a solution for the physical dynamics of the objects in the second binary object at the second set of links (**pages 289 - 290, section 8.2.4**);

o. The motivation to use the art of Jalon with the art of Fisette would have been the benefit recited in Jalon that two of the most efficient formulations of dynamics are presented (**page 271, first and second paragraphs**), which would have been recognized by the ordinary artisan as saving time.

p. Therefore, as discussed above, it would have been obvious to the ordinary artisan at the time of invention to use the art of Jalon with the art of Fisette to produce the invention of claim 1.

q. Regarding **claim 16**:

r. Fisette appears to teach:

s. a. grouping the objects in the predetermined set of objects into two binary objects to define a first binary object and a second binary object (**page 193, figure 4, part b**);

t. b. grouping the objects in the first binary object into a subgroup of binary objects to define a nested group of binary objects in the first binary object (**page 193, figure 4, part b**);

u. c. grouping the objects in the second binary object into a subgroup of binary objects to define a nested group of binary objects in the second-binary object (**page 193, figure 4, part b**);

v. Fisette does not explicitly teach:

w. d. starting with the most deeply nested binary object and proceeding outward, solving a solution for the physical dynamics of the objects in the binary objects at the respective links.

x. Jalon appears to teach:

y. d. starting with the most deeply nested binary object and proceeding outward, solving a solution for the physical dynamics of the objects in the binary objects at the respective links (**pages 289 - 290, section 8.2.4; it would have been obvious that a recursive solution would start with the most deeply nested binary object**);

z. The motivation to use the art of Jalon with the art of Fisette would have been the benefit recited in Jalon that two of the most efficient formulations of dynamics are presented (**page 271, first and second paragraphs**), which would have been recognized by the ordinary artisan as saving time.

aa. Therefore, as discussed above, it would have been obvious to the ordinary artisan at the time of invention to use the art of Jalon with the art of Fisette to produce the invention of claim 16.

bb. Regarding **claim 25**:

cc. Fisette appears to teach:

dd. a. creating a nested grouping of a plurality of binary objects from the objects in the set, at least one binary object containing two or more links (**page 193, figure 4, part b**);

ee. Fisette does not explicitly teach:

ff. b. starting with the most deeply nested binary object and proceeding outward, solving for the physical dynamics of the objects in the binary objects at said one or more links.

gg. Jalon appears to teach:

hh. b. starting with the most deeply nested binary object and proceeding outward, solving for the physical dynamics of the objects in the binary objects at said one or more links (**pages 289 - 290, section 8.2.4; it would have been obvious that a recursive solution would start with the most deeply nested binary object**);

ii. The motivation to use the art of Jalon with the art of Fisette would have been the benefit recited in Jalon that two of the most efficient formulations of dynamics are presented (**page 271, first and second paragraphs**), which would have been recognized by the ordinary artisan as saving time.

jj. Therefore, as discussed above, it would have been obvious to the ordinary artisan at the time of invention to use the art of Jalon with the art of Fisette to produce the invention of claim 25.

kk. Regarding **claim 45**:

ll. Fisette appears to teach:

mm. a. a binary division unit having logic operable to create a nested grouping of a plurality of binary objects from the objects in the set (**page 193, figure 4, part b**);

nn.c. one or more central processing units supporting the system (**page 198, section 4.2 Computational efficientcy, at least, "… CPU time of the numerical simulation …", and "… a 1.4 M flops SUN station"**).

oo. Fisette does not explicitly teach:

pp.b. a dynamics unit having logic operable to solve a set of physical dynamics equations.

qq. Jalon appears to teach:

rr. b. a dynamics unit having logic operable to solve a set of physical dynamics equations (**pages 289 - 290, section 8.2.4**);

ss. The motivation to use the art of Jalon with the art of Fisette would have been the benefit recited in Jalon that two of the most efficient formulations of dynamics are presented (**page 271, first and second paragraphs**), which would have been recognized by the ordinary artisan as saving time.

tt. Therefore, as discussed above, it would have been obvious to the ordinary artisan at the time of invention to use the art of Jalon with the art of Fisette to produce the invention of claim 45.

16. **Claims 2 - 9, 17 - 24, 26 - 33** are rejected under 35 U.S.C. 103(a) as being unpatentable over Fisette as modified by Jalon as applied to claims **1, 16, 25 and 45** above, further in view of Baraff1994A (David Baraff; "Non-penetrating Rigid Body Simulation", 1994, Eurographics 1993 State of the Art Reports, pages 1 - 23).

a. Fisette as modified by Jalon teaches a method of simulating physical dynamics of a set of objects connected to each other by links as recited in claims **1, 16, 25 and 45** above.

b. Regarding **claim 2**:

c. Fisette does not specifically teach:

d. providing, for each link, one or more link weight values operable to constrain the solution.

e. Baraff1994A appears to teach:

f. providing, for each link, one or more link weight values operable to constrain the solution (**pages 13 – 15, section 4.2 Penalty Method; it would have been obvious that a penalty value would have been provided for each link**).

g. Regarding **claim 3**:

h. Fisette does not specifically teach:

i. Performing an iterative solution method multiple times where at least one link weight value is adjusted at each iteration.

j. Baraff1994A appears to teach:

k. Performing an iterative solution method multiple times where at least one link weight value is adjusted at each iteration (**pages 13 – 15, section 4.2 Penalty Method; it would have been obvious that the penalty method is iterative and a penalty value would have been adjusted at each iteration of a penalty solution**).

l. Regarding **claim 4**:

m. Fisette does not specifically teach:

n. the link weight values are adjusted to maintain a set of constraints on the links within a predetermined acceptable tolerance.

o. Baraff1994A appears to teach:

p. the link weight values are adjusted to maintain a set of constraints on the links within a predetermined acceptable tolerance (**pages 13 - 15, section 4.2 Penalty Method; it would have been obvious that a penalty value would have been adjusted at each iteration of a penalty solution**).

q. Regarding **claim 5**:

r. Fisette does not specifically teach:

s. the set of constraints includes the following constraints: the objects cannot interpenetrate each other and no adhesive normal forces are applied at the links.

t. Baraff1994A appears to teach:

u. the set of constraints includes the following constraints: the objects cannot interpenetrate each other and no adhesive normal forces are applied at the links (**page 9, sections 4.0 and 4.1**).

v. Regarding **claim 6**:

w. Fisette does not specifically teach:

x. the predetermined acceptable tolerance includes a predetermined amount of interpenetration at a link.

y. Baraff1994A appears to teach:

z. the predetermined acceptable tolerance includes a predetermined amount of interpenetration at a link (**pages 13 - 15,section 4.2 The Penalty Method; it would have been obvious that the penalty method has a tolerance for interpenetration**).

aa. Regarding **claim 7**:

bb. Fisette does not specifically teach:

cc. the predetermined acceptable tolerance includes a predetermined amount of adhesive normal force at a link.

dd. Baraff1994A appears to teach:

ee. the predetermined acceptable tolerance includes a predetermined amount of adhesive normal force at a link (**page 17, section 5.3 Static Friction; it would have been obvious that static friction is a tolerance of adhesive force before dynamic slipping occurs**).

ff. Regarding **claim 8**:

gg. Fisette does not specifically teach:

hh. the set of constraints further includes the constraint that, at a respective link, either the relative lateral motion is zero or the friction force at the link is equal to the normal force times a coefficient of friction.

ii. Baraff1994A appears to teach:

jj. the set of constraints further includes the constraint that, at a respective link, either the relative lateral motion is zero or the friction force at the link is equal to the normal force times a coefficient of friction (**page 17, section 5.2 Dynamic friction conditions and section 5.3 Static Friction**).

kk. Regarding **claim 9**:

ll. Fisette does not specifically teach:

mm. the predetermined acceptable tolerance includes a predetermined difference between the friction force at a link and the normal force times the coefficient of friction.

nn. Baraff1994A appears to teach:

oo. the predetermined acceptable tolerance includes a predetermined difference between the friction force at a link and the normal force times the coefficient of friction (**page 17, section 5.3 Static Friction; it would have been obvious that the threshold of dynamic friction from slipping is a predetermined difference between the friction force at a link and the normal force times the coefficient of friction**).

pp. Regarding **claim 17**:

qq. Fisette does not specifically teach:

rr. providing, for each link, one or more link weight values operable to constrain the solution.

ss. Baraff1994A appears to teach:

tt. providing, for each link, one or more link weight values operable to constrain the solution (**pages 13 – 15, section 4.2 Penalty Method; it would have been obvious that a penalty value would have been provided for each link**).

uu. Regarding **claim 18**:

vv. Fisette does not specifically teach:

ww. performing an iterative solution method multiple times where at least one link weight value is adjusted at each iteration.

xx. Baraff1994A appears to teach:

yy. performing an iterative solution method multiple times where at least one link weight value is adjusted at each iteration ((**pages 13 – 15, section 4.2 Penalty Method; it would have been obvious that a penalty value would have been adjusted at each iteration of a penalty solution**).

zz. Regarding **claim 19**:

aaa. Fisette does not specifically teach:

bbb. the link weight values are adjusted to maintain a set of constraints on the links within a predetermined acceptable tolerance.

ccc. Baraff1994A appears to teach:

ddd. the link weight values are adjusted to maintain a set of constraints on the links within a predetermined acceptable tolerance (**pages 13 – 15, section 4.2 Penalty Method; it would have been obvious that a penalty value would have been adjusted at each iteration of a penalty solution**).

eee. Regarding **claim 20**:

fff. Fisette does not specifically teach:

ggg. the set of constraints includes the following constraints: the objects cannot interpenetrate each other and no adhesive normal forces are applied at the links.

hhh. Baraff1994A appears to teach:

iii. the set of constraints includes the following constraints: the objects cannot interpenetrate each other and no adhesive normal forces are applied at the links (**page 9, sections 4.0 and 4.1**).

jjj. Regarding **claim 21**:

kkk. Fisette does not specifically teach:

lll. the predetermined acceptable tolerance includes a predetermined amount of interpenetration at a link.

mmm. Baraff1994A appears to teach:

nnn. the predetermined acceptable tolerance includes a predetermined amount of interpenetration at a link (**pages 13 – 15,section 4.2 The Penalty Method; it would have been obvious that the penalty method has a tolerance for interpenetration**).

ooo. Regarding **claim 22**:

ppp. Fisette does not specifically teach:

qqq. the predetermined acceptable tolerance includes a predetermined amount of adhesive normal force at a link.

rrr. Baraff1994A appears to teach:

sss. the predetermined acceptable tolerance includes a predetermined amount of adhesive normal force at a link (**page 17, section 5.3 Static Friction; it would have been obvious that static friction is a tolerance of adhesive force before dynamic slipping occurs**).

ttt. Regarding **claim 23**:

uuu. Fisette does not specifically teach:

vvv. the set of constraints further includes the constraint that, at a respective link, either the relative lateral motion is zero or the friction force at the link is equal to the normal force times a coefficient of friction.

www. Baraff1994A appears to teach:

xxx. the set of constraints further includes the constraint that, at a respective link, either the relative lateral motion is zero or the friction force at the link is equal to the normal force times a coefficient of friction (**page 17, section 5.2 Dynamic friction conditions and section 5.3 Static Friction**).

yyy. Regarding **claim 24**:

zzz. Fisette does not specifically teach:

aaaa. the predetermined acceptable tolerance includes a predetermined difference between the friction force at a link and the normal force times the coefficient of friction.

bbbb. Baraff1994A appears to teach:

cccc. the predetermined acceptable tolerance includes a predetermined difference between the friction force at a link and the normal force times the coefficient of friction (**page 17, section 5.3 Static Friction; it would have been obvious that the threshold of dynamic friction from slipping is a predetermined difference between the friction force at a link and the normal force times the coefficient of friction**).

dddd. Regarding **claim 26**:

eeee. Fisette does not specifically teach:

ffff. the solution maintains a set of constraints on the links within a predetermined acceptable tolerance.

gggg. Baraff1994A appears to teach:

hhhh. the solution maintains a set of constraints on the links within a predetermined acceptable tolerance (**pages 13 – 15, section 4.2 Penalty Method; it would have been obvious that a penalty value would have been adjusted at each iteration of a penalty solution**).

iiii. Regarding **claim 27**:

jjjj. Fisette does not specifically teach:

kkkk. the set of constraints includes the following constraints: the objects cannot interpenetrate each other and no adhesive normal forces are applied at the links.

llll. Baraff1994A appears to teach:

mmmm. the set of constraints includes the following constraints: the objects cannot interpenetrate each other and no adhesive normal forces are applied at the links (**page 9, sections 4.0 and 4.1**).

nnnn. Regarding **claim 28**:

oooo. Fisette does not specifically teach:

pppp. the predetermined acceptable tolerance includes a predetermined amount of interpenetration at a link.

qqqq. Baraff1994A appears to teach:

rrrr. the predetermined acceptable tolerance includes a predetermined amount of interpenetration at a link (**pages 13 – 15,section 4.2 The Penalty Method; it would have been obvious that the penalty method has a tolerance for interpenetration**).

ssss. Regarding **claim 29**:

tttt. Fisette does not specifically teach:

uuuu. the predetermined acceptable tolerance includes a predetermined amount of adhesive normal force at a link.

vvvv. Baraff1994A appears to teach:

wwww. the predetermined acceptable tolerance includes a predetermined amount of adhesive normal force at a link (**page 17, section 5.3 Static Friction; it would have been obvious that static friction is a tolerance of adhesive force before dynamic slipping occurs**).

xxxx. Regarding **claim 30**:

yyyy. Fisette does not specifically teach:

zzzz. the set of constraints further includes the constraint that, at a respective link, either the relative lateral motion is zero or the friction force at the link is equal to the normal force times a coefficient of friction.

aaaaa. Baraff1994A appears to teach:

bbbbb. the set of constraints further includes the constraint that, at a respective link, either the relative lateral motion is zero or the friction force at the link is equal to the normal force times a coefficient of friction (**page 17, section 5.2 Dynamic friction conditions and section 5.3 Static Friction**).

ccccc. Regarding **claim 31**:

ddddd. Fisette does not specifically teach:

eeeee. the predetermined acceptable tolerance includes a predetermined difference between the friction force at a link and the normal force times the coefficient of friction.

fffff. Baraff1994A appears to teach:

ggggg. the predetermined acceptable tolerance includes a predetermined difference between the friction force at a link and the normal force times the coefficient of friction (**page 17, section 5.3 Static Friction; it would have been obvious that the threshold of dynamic friction from slipping is a predetermined difference between the friction force at a link and the normal force times the coefficient of friction**).

hhhhh. Regarding **claim 32**:

iiiii. Fisette does not specifically teach:

jjjjj.providing, for each link, one or more link weight values operable to constrain the solution.

kkkkk. Baraff1994A appears to teach:

lllll. providing, for each link, one or more link weight values operable to constrain the solution (**pages 13 – 15, section 4.2 Penalty Method; it would have been obvious that a penalty value would have been provided for each link**).

mmmmm. Regarding **claim 33**:

nnnnn. Fisette does not specifically teach:

ooooo.performing an iterative solution method multiple times where at least one link weight value is adjusted at each iteration.

ppppp. Baraff1994A appears to teach:

qqqqq. performing an iterative solution method multiple times where at least one link weight value is adjusted at each iteration (**pages 13 – 15, section 4.2 Penalty Method; it would have been obvious that a penalty value would have been adjusted at each iteration of a penalty solution**).

17. **Claims 34 - 44** are rejected under 35 U.S.C. 103(a) as being unpatentable over Baraff1994A (David Baraff; "Non-penetrating Rigid Body Simulation", 1994, Eurographics 1993 State of the Art Reports, pages 1 - 23) in view of Baraff1993 (David Baraff; "Issues in Computing Contact Forces for Non-Penetrating Rigid Bodies", 1993, Algorithmica, Volume 10, pages 292 - 352).

a. The art of Baraff1994A is directed to rigid body simulation (Title).

b. The art of Baraff1993 is directed to rigid body simulation (Title).

c. The art of Baraff1994A and the art of Baraff1993 are analogous art because they are both directed to the art of rigid body simulation.

d. Regarding **claim 34**:

e. Baraff1994A appears to teach:

f. a. providing a set of equations that when solved define a solution to the physical dynamics of the predetermined set of objects (**pages 12 - 13, section 4.1.2**), the solution having the following constraints: the objects cannot interpenetrate each other and no adhesive normal forces can be applied at the links (**page 9, sections 4.0 and 4.1**);

g. b. assigning at least one link weight to each of the links in the predetermined set of objects (**pages 13 - 15, section 4.2 Penalty Method; it would have been obvious that a separate penalty value would have been assigned for each link**);

h. d. adjusting the assigned link weights if the constraints are violated at a link (**pages 13 - 15, section 4.2 Penalty Method; it would have been obvious that a separate penalty value would have been adjusted for each link if the constraints were violated at a link**);

i. Baraff1994A does not specifically teach:

j. c. solving for the physical dynamics of the objects using the assigned weights using an iterative solution method;

k. e. solving an iterative solution for the physical dynamics of the objects using the adjusted weights;

l. f. repeating steps d. and e. until a solution is within a predetermined acceptable tolerance.

m. Baraff1993 appears to teach:

n. c. solving for the physical dynamics of the objects using the assigned weights using an iterative solution method (**pages 345 - 347, Appendix B. Iterative Solution Methods for Static Friction**);

o. e. solving an iterative solution for the physical dynamics of the objects using the adjusted weights (**pages 345 – 347, Appendix B. Iterative Solution Methods for Static Friction**);

p. f. repeating steps d. and e. until a solution is within a predetermined acceptable tolerance (**pages 345 – 347, Appendix B. Iterative Solution Methods for Static Friction**).

q. The motivation to use the art of Baraff1993 with the art of Baraff1994A would have been the knowledge of the ordinary artisan that iterative solutions are simple to apply, which would have been recognized as a benefit by the ordinary artisan.

r. Therefore, as discussed above, it would have been obvious to the ordinary artisan at the time of invention to use the art of Baraff1993 with the art of Baraff1994A to produce the invention of claim 34.

s. Regarding **claim 35**:

t. Baraff1994A appears to teach:

u. a predetermined acceptable tolerance includes a predetermined amount of adhesive normal force at a link (**page 17, section 5.3 Static Friction; it would have been obvious that static friction is a tolerance of adhesive force before dynamic slipping occurs**).

v. Regarding **claim 36**:

w. Baraff1994A appears to teach:

x. the predetermined acceptable tolerance includes a predetermined amount of interpenetration between two objects at a link (**pages 13 – 15,section 4.2 The Penalty Method; it would have been obvious that the penalty method has a tolerance for interpenetration**).

y. Regarding **claim 37**:

z. Baraff1994A appears to teach:

aa. the weights are decreased for links where adhesive normal force is applied (**pages 13 – 15,section 4.2 The Penalty Method; it would have been obvious that the penalty method decreases weights where adhesive normal force is applied**).

bb. Regarding **claim 38**:

cc. Baraff1994A appears to teach:

dd. the weights are increased for links where interpenetration occurs (**pages 13 – 15,section 4.2 The Penalty Method; it would have been obvious that the penalty method increases weights where interpenetration occurs**).

ee. Regarding **claim 39**:

ff. Baraff1994A appears to teach:

gg. a. providing a set of equations that when solved define a solution to the physical dynamics of the predetermined set of objects (**pages 12 – 13, section 4.1.2**), the solution having the following constraints: the objects cannot interpenetrate each other and no adhesive normal forces can be applied at the links (**page 9, sections 4.0 and 4.1**), and that, at a respective link, either the relative lateral velocity is zero, or the friction force is equal to the normal force at the link times the coefficient of friction (**page 17, sections 5.2 and 5.3**);

hh. b. assigning at least one link weight to each of the links in the predetermined set of objects (**pages 13 – 15, section 4.2 Penalty Method; it would have been obvious that a separate penalty value would have been assigned for each link**);

ii. d. adjusting the link weights assigned to the links if the constraints are violated at a link (**pages 13 – 15, section 4.2 Penalty Method; it would have been obvious that a separate penalty value would have been adjusted for each link if the constraints were violated at a link**);

jj. Baraff1994A does not specifically teach:

kk. c. solving for the physical dynamics of the objects using the assigned weights using an iterative solution method;

ll. e. solving an iterative solution for the physical dynamics of the objects using the adjusted weights; and

mm. f. repeating steps d. and e. until a solution is within a predetermined acceptable tolerance.

nn. Baraff1993 appears to teach:

oo. c. solving for the physical dynamics of the objects using the assigned weights using an iterative solution method (**pages 345 - 347, Appendix B. Iterative Solution Methods for Static Friction**);

pp. e. solving an iterative solution for the physical dynamics of the objects using the adjusted weights (**pages 345 - 347, Appendix B. Iterative Solution Methods for Static Friction**);

qq. f. repeating steps d. and e. until a solution is within a predetermined acceptable tolerance (**pages 345 - 347, Appendix B. Iterative Solution Methods for Static Friction**).

rr. The motivation to use the art of Baraff1993 with the art of Baraff1994A would have been the knowledge of the ordinary artisan that iterative solutions are simple to apply, which would have been recognized as a benefit by the ordinary artisan.

ss. Therefore, as discussed above, it would have been obvious to the ordinary artisan at the time of invention to use the art of Baraff1993 with the art of Baraff1994A to produce the invention of claim 39.

tt. Regarding **claim 40**:

uu. Baraff1994A appears to teach:

vv. a predetermined acceptable tolerance includes a predetermined amount of adhesive normal force at a link (**page 17, section 5.3 Static Friction; it would have been obvious that static friction is a tolerance of adhesive force before dynamic slipping occurs**).

ww. Regarding **claim 41**:

xx. Baraff1994A appears to teach:

yy. the predetermined acceptable tolerance includes a predetermined amount of interpenetration between two objects at a link (**pages 13 - 15,section 4.2 The Penalty Method; it would have been obvious that the penalty method has a tolerance for interpenetration**).

zz. Regarding **claim 42**:

aaa. Baraff1994A appears to teach:

bbb. the predetermined acceptable tolerance includes a predetermined difference between the friction force at a link and the normal force times a coefficient of friction (**page 17, section 5.3 Static Friction; it would have been obvious that the threshold of dynamic friction from slipping is a predetermined difference between the friction force at a link and the normal force times the coefficient of friction**).

ccc. Regarding **claim 43**:

ddd. Baraff1994A appears to teach:

eee. the weights are decreased for links where adhesive normal force is applied (**pages 13 - 15,section 4.2 The Penalty Method; it would have been obvious that the penalty method decreases weights where adhesive normal force is applied**).

fff. Regarding **claim 44**:

ggg. Baraff1994A appears to teach:

hhh. the weights are increased for links where interpenetration occurs (**pages 13 - 15,section 4.2 The Penalty Method; it would have been obvious that the penalty method increases weights where interpenetration occurs**).

18. **Claim 10** is rejected under 35 U.S.C. 103(a) as being unpatentable over Son (Wookho Son; "Hybrid Dynamic Simulation of Rigid-Body Contact with Coulomb Friction", 2001, Proceedings of the 2001 IEEE International Conference on Robotics & Automation, pages 1376 - 1381) in view of Baraff1994A (David Baraff; "Non-penetrating Rigid Body Simulation", 1994, Eurographics 1993 State of the Art Reports, pages 1 - 23).

a. The art of Son is directed to rigid body simulation (Title).

b. The art of Baraff1994A is directed to rigid body simulation (Title).

c. The art of Baraff1994A and the art of Son are analogous art because they are both directed to the art of rigid body simulation.

d. Son appears to teach:

e. a. providing, for at least one object, a set of reaction values describing the motion of the object in response to applied forces (**pages 1378 - 1379, section 3.3 Complementarity Formulation of Time-Stepping; and page 1379, figure 2**);

f. b. solving for the physical dynamics of the set of objects using the reaction values (**pages 1378 - 1379, section 3.3 Complementarity Formulation of Time-Stepping; and page 1379, figure 2**);

g. c. changing the reaction values in response to force for at least one object to provide a set of adjusted reaction values (**pages 1378 - 1379, section 3.3 Complementarity Formulation of Time-Stepping; and page 1379, figure 2**);

h. d. solving for the physical dynamics of the objects using the set of adjusted reaction values (**pages 1378 - 1379, section 3.3**

Complementarity Formulation of Time-Stepping; and page 1379, figure 2); and

i. Son does not specifically teach:

j. e. repeating steps c and e until the solution of step d is within a predetermined acceptable tolerance.

k. Baraff1994A appears to teach:

l. e. repeating steps c and e until the solution of step d is within a predetermined acceptable tolerance (**pages 13 – 15, section 4.2 The Penalty Method**).

m. The motivation to use the art of Baraff1994A with the art of Son would have been the knowledge of the ordinary artisan that iterative solutions are simple to apply, which would have been recognized as a benefit by the ordinary artisan.

n. Therefore, as discussed above, it would have been obvious to the ordinary artisan at the time of invention to use the art of Baraff1994A with the art of Son to produce the invention of claim 10.

19. **Claim 11** is rejected under 35 U.S.C. 103(a) as being unpatentable over Son as modified by Baraff1994A as applied to claim 10 above, further in view of Fisette.

a. Son as modified by Baraff1994A teaches a method of simulating physical dynamics of a set of objects connected to each other by a link as recited in claim 10 above.

b. Regarding **claim 11**:

c. Son does not specifically teach:

d. creating a nested grouping of a plurality of binary objects from the objects in the set.

e. Fisette appears to teach:

f. creating a nested grouping of a plurality of binary objects from the objects in the set (**page 193, figure 4, part b a binary tree multibody**).

g. The motivation to use the art of Fisette with the art of Son as modified by Baraff1994A would have been the benefit recited in Fisette that a multibody system can be efficiently modeled (**page 187, Summary**), which would have been recognized as a benefit by the ordinary artisan.

h. Therefore, as discussed above, it would have been obvious to the ordinary artisan at the time of invention to use the art of Fisette with the art of Son as modified by Baraff1994A to produce the invention of claim 11.

20. **Claims 12 - 15** are rejected under 35 U.S.C. 103(a) as being unpatentable over Son as modified by Baraff1994A and Fisette as applied to claim 11 above, further in view of Jalon.

a. Son as modified by Baraff1994A and Fisette teaches a method of simulating physical dynamics of a set of objects connected to each other by a link as recited in claim 11 above.

b. Regarding **claim 12**:

c. Son does not explicitly teach:

d. b. starting with the most deeply nested binary object and proceeding outward, solving for the physical dynamics of the objects in the binary objects at the respective links.

e. Jalon appears to teach:

f. b. starting with the most deeply nested binary object and proceeding outward, solving for the physical dynamics of the objects in the binary

objects at the respective links (**pages 289 - 290, section 8.2.4; it would have been obvious that a recursive solution would start with the most deeply nested binary object**);

g. The motivation to use the art of Jalon with the art of Son as modified by Baraff1994A and Fisette would have been the benefit recited in Jalon that two of the most efficient formulations of dynamics are presented (**page 271, first and second paragraphs**), which would have been recognized by the ordinary artisan as saving time.

h. Therefore, as discussed above, it would have been obvious to the ordinary artisan at the time of invention to use the art of Jalon with the art of Son as modified by Baraff1994A and Fisette to produce the invention of claim 12.

i. Regarding **claim 13**:

j. Fisette does not specifically teach:

k. providing, for each link, one or more link weight values operable to constrain the solution.

l. Baraff1994A appears to teach:

m. providing, for each link, one or more link weight values operable to constrain the solution (**pages 13 - 15, section 4.2 Penalty Method; it would have been obvious that a penalty value would have been provided for each link**).

n. Regarding **claim 14**:

o. Fisette does not specifically teach:

p. Adjusting at least one link weight value.

q. Baraff1994A appears to teach:

r. Adjusting at least one link weight value (**pages 13 - 15, section 4.2 Penalty Method; it would have been obvious that the penalty method is iterative and a penalty value would have been adjusted at each iteration of a penalty solution**).

s. Regarding **claim 15**:

t. Fisette does not specifically teach:

u. the link weight values are adjusted to maintain a set of constraints on the links within a predetermined acceptable tolerance.

v. Baraff1994A appears to teach:

w. the link weight values are adjusted to maintain a set of constraints on the links within a predetermined acceptable tolerance (**pages 13 - 15, section 4.2 Penalty Method; it would have been obvious that a penalty value would have been adjusted at each iteration of a penalty solution**).

21. **Claims 46 - 47** are rejected under 35 U.S.C. 103(a) as being unpatentable over Fisette as modified by Jalon as applied to claims **1, 16, 25 and 45** above, further in view of Cuadrado (J. Cuadrado et al.; "Intelligent Simulation of Multibody Dynamics: Space-State and Descriptor Methods in Sequential and Parallel Computing Environments", 2000, Multibody System Dynamics, Volume 4, Number 1, pages 55 - 73).

a. Fisette as modified by Jalon teaches a method of simulating physical dynamics of a set of objects connected to each other by links as recited in claims **1, 16, 25 and 45** above.

b. Regarding **claim 46**:

c. Fisette does not specifically teach:

d. the dynamics unit comprises a set of multiple processors, each processor operable to solve a set of physical dynamics equations.

e. Cuadrado appears to teach:

f. the dynamics unit comprises a set of multiple processors, each processor operable to solve a set of physical dynamics equations (**page 68, section 4.3 Results on Parallel Machines**).

g. The motivation to use the art of Cuadrado with the art of Fisette as modified by Jalon would have been the benefit recited in Cuadrado that the method reduces CPU time up to 30% (**page 68, section 4.3 Results on Parallel Machines**).

h. Therefore, as discussed above, it would have been obvious to the ordinary artisan at the time of invention to use the art of Cuadrado with the art of Fisette as modified by Jalon to produce the invention of claim 46.

i. Regarding **claim 47**:

j. Fisette does not specifically teach:

k. `said multiple processors are used to solve the dynamics equations of multiple binary objects in parallel.`

l. Cuadrado appears to teach:

m. `said multiple processors are used to solve the dynamics equations of multiple binary objects in parallel (`**`page 68, section 4.3 Results on Parallel Machines`**`).`

22. **Claims 48 - 52** are rejected under 35 U.S.C. 103(a) as being unpatentable over Fisette as modified by Jalon and Cuadrado as applied to claims 46 - 47 above, further in view of Baraff1994A (David Baraff; "Non-penetrating Rigid Body Simulation", 1994, Eurographics 1993 State of the Art Reports, pages 1 - 23).

a. Fisette as modified by Jalon and Cuadrado teaches a method of simulating physical dynamics of a set of objects connected to each other by links as recited in claims 46 - 47 above.

b. Regarding **claim 48**:

c. Fisette does not specifically teach:

d. `each link includes one or more link weight values operable to constrain the solution.`

e. Baraff1994A appears to teach:

f. each link includes one or more link weight values operable to constrain the solution (**pages 13 – 15, section 4.2 Penalty Method; it would have been obvious that a penalty value would have been provided for each link**).

g. The motivation to use the art of Baraff1994A with Fisette as modified by Jalon and Cuadrado would have been the knowledge of the ordinary artisan that iterative solutions are simple to apply, which would have been recognized as a benefit by the ordinary artisan.

h. Therefore, as discussed above, it would have been obvious to the ordinary artisan at the time of invention to use the art of Baraff1994A with Fisette as modified by Jalon and Cuadrado to produce the invention of claim 48.

i. Regarding **claim 49**:

j. Fisette does not specifically teach:

k. Perform an iterative solution method multiple times one or more link weight values are adjusted at each iteration.

l. Baraff1994A appears to teach:

m. Perform an iterative solution method multiple times one or more link weight values are adjusted at each iteration (**pages 13 – 15, section 4.2 Penalty Method; it would have been obvious that the penalty method is iterative and a penalty value would have been adjusted at each iteration of a penalty solution**).

n. Regarding **claim 50**:

o. Fisette does not specifically teach:

p. the link weight values are adjusted to maintain a set of constraints for each link within a predetermined tolerance.

q. Baraff1994A appears to teach:

r. the link weight values are adjusted to maintain a set of constraints for each link within a predetermined tolerance (**pages 13 – 15, section 4.2 Penalty Method; it would have been obvious that a penalty value would have been adjusted at each iteration of a penalty solution**).

s. Regarding **claim 51**:

t. Fisette does not specifically teach:

u. the set of constraints includes the following constraints: the objects cannot interpenetrate each other and no adhesive normal force is applied.

v. Baraff1994A appears to teach:

w. the set of constraints includes the following constraints: the objects cannot interpenetrate each other and no adhesive normal force is applied (**page 9, sections 4.0 and 4.1**).

x. Regarding **claim 52**:

y. Fisette does not specifically teach:

z. the set of constraints further includes the constraint that, at a respective link, either the relative lateral motion is zero or the friction force at the link is equal to the normal force times a coefficient of friction.

aa. Baraff1994A appears to teach:

bb. the set of constraints further includes the constraint that, at a respective link, either the relative lateral motion is zero or the friction force at the link is equal to the normal force multiplied by a coefficient of friction (**page 17, section 5.2 Dynamic friction conditions and section 5.3 Static Friction**).

23. **Examiner's Note:** Examiner has cited particular columns and line numbers in the references applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings of the art and are applied to specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the Applicant in preparing responses, to fully consider the references in their entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner. The entire reference is considered to provide disclosure relating to the claimed invention.

Conclusion

24. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

25. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

26. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Russ Guill whose telephone number is 571-272-7955. The examiner can normally be reached on Monday – Friday 9:30 AM – 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached on 571-272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Any inquiry of a general nature or relating to the status of this application should be directed to the TC2100 Group Receptionist: 571-272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Jason Proctor/

Primary Examiner, Art Unit 2123

Russ Guill
Examiner
Art Unit 2123

RG